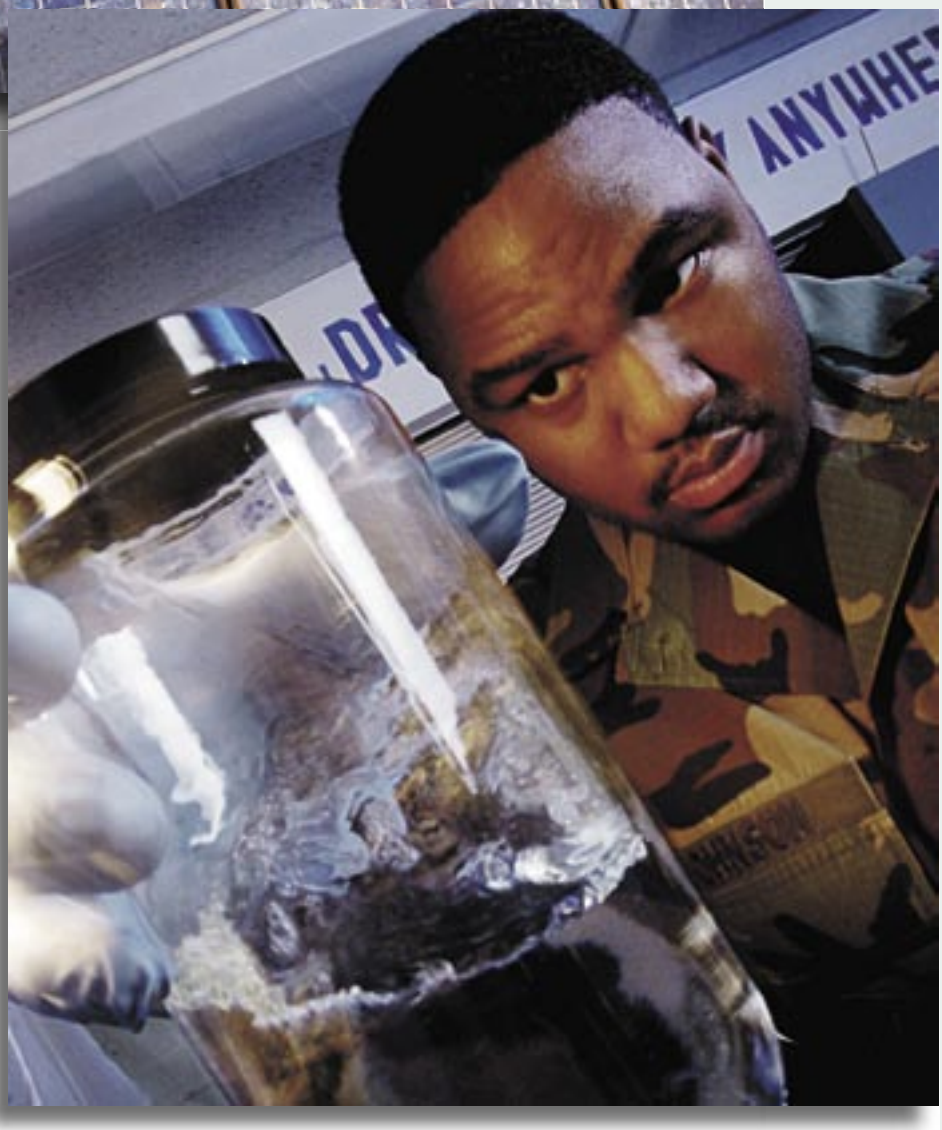
U.S. AIR FORCE

Renewable Energy Program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The mission of the United States Air Force, "to deliver sovereign options for the defense of the United States of America and its global interests," is both highly technical and energy intensive. Air Force energy uses include facility energy to power installations around the world, jet fuel for transport aircraft that carry our troops at home and abroad, and electricity for research wind tunnels. These are all part of the energy portfolio required to meet the Air Force mission, both today and in the future.

The nation is focused on the need for alternative sources of energy as a result of the events of the past year. The hurricanes of 2005 that damaged off-shore petroleum production and on-shore refineries caused shortages that were felt throughout the country. However, long before Hurricane Katrina hit the Gulf Coast, the Air Force was dedicated to finding alternative sources of energy to replace traditional fossil fuels, as well as aggressively reducing the demand through targeted energy conservation initiatives. Our energy strategy focuses on making energy a consideration in all Air Force actions and accelerating development and use of alternative fuels.

The reliance on imported oil continues to threaten the economic, financial and physical security of the nation, while the use of domestic fossil fuels contributes to nationwide pollution problems. The Air Force believes that development of renewable energy sources for facility energy is one important element of our comprehensive strategy.

The Air Force supports the development of the renewable energy industry in several ways. We are developing on-base renewable resources including electric generation from photovoltaic panels, landfill gas and wind generators. Supported by the Air Force Civil Engineer Support Agency, 37 Air Force installations participated in a renewable power purchase program in fiscal year 2005, including five that purchased 100 percent of their electricity from renewable sources—11 percent of the Air Force annual electrical power requirement. These efforts led to the selection of the Air Force as a winner of the U.S. EPA's Climate Change Award.

Like facilities, ground vehicles are a very important part of accomplishing the Air Force mission. We are currently testing and developing several innovative methods of powering ground vehicles, such as the use of synthetic fuels, hydrogen and hybrid diesel-electric power.

This document illustrates the breadth and depth of the Air Force's efforts to adopt technologies that will reduce our dependence on traditional fuels and increase our reliance on fuels that are naturally replenished. We are encouraged by the continued development of domestic renewable energy sources. Developing renewable energy is a long-term, strategic commitment by your Air Force—we look forward to continued partnerships with industry to expand this trend.

Secretary of the Air Force

Helping Air Force Blue Turn Green

The Air Force is known for its high-tech assets, but the service is starting to garner attention for high-tech solutions bases are using to help reduce energy costs.

We spend more than $1.2 billion a year on facility energy and fuels for our ground fleet. To help reduce these costs, we have begun investing in advanced energy technologies like wind and solar to lower the cost of heating and cooling buildings, and hydrogen and renewable energy sources to operate our ground vehicles and equipment.

While some of these programs are in their infancy and savings have just started to be realized, others are fully mature and have already proven successful at helping us meet our energy goals and save taxpayer dollars.

We began exploring alternative fuel choices as early as 1990, as congressional and presidential mandates directed federal agencies to further increase energy conservation efforts. Although we had achieved measurable success with “traditional” methods of conservation, the new mandates encouraged our energy

managers to begin looking to the alternative fuels industry for ways to do even better.

Initially, most alternative fuels were cost-prohibitive, but as the industry grew and its customer base expanded, prices became comparable to—and, in some cases, lower than—traditional petroleum-based energy sources.

In a few short years, the Air Force has become a leading purchaser of renewable facility energy, and we have made major inroads in bringing more alternative-powered ground vehicles and equipment into the inventory. But there's more to do as our energy management teams continue to look for ways to help Air Force blue turn green.

Facility Energy

For years, the Air Force has been a leader in energy conservation in the Department of Defense. Since 1985, we have significantly reduced facility energy usage on installations by incorporating energy conservation practices into the daily fabric of the Air Force. It is a balancing act as our energy managers work to minimize energy consumption and cost while meeting mission objectives and providing quality working and living conditions for Air Force personnel and family housing occupants.

About 10 years ago, we began expanding our energy conservation efforts by investing in renewable energy sources. This approach quickly paid dividends, and in 2005 we became the top purchaser of renewable energy in the United States and the third largest purchaser of green power in the world. We purchased enough green power that year—about 1,060 gigawatt hours—to power 70,000 average-sized homes for a year.

These impressive numbers also make us the largest purchaser of renewable power in the federal government. Last year, we accounted for nearly half of all green power purchases made by federal agencies.

The Air Force consumes about 77 trillion BTUs of facility energy annually at a cost of more than $945 million. Renewable power now accounts for 11 percent of our energy purchases, and we are actively looking for ways to significantly increase that amount. By locking in long-term green power contracts at fixed prices today, we help ensure reasonably priced utility rates in the future no matter what the market might do.

Our renewable energy portfolio includes:

Wind Power

We currently have two wind power projects in operation and have several more under consideration. We also purchase power generated by wind turbines.

- A 2.7-megawatt wind farm on Ascension Island provides about 4,600 megawatt hours of electrical power per year to the Air Force installation there.

- A 1.3-megawatt wind farm at F.E. Warren AFB, Wyo., provides about 4,400 megawatt hours of electrical power to the installation per year.

- Dyess AFB, Texas; Fairchild AFB, Wash.; Minot AFB, N.D.; and Columbus AFB, Miss., receive 100 percent of their energy from wind or other renewable power sources provided by local utility companies.

- A 250-kilowatt wind turbine at the Tin City, Alaska, long-range radar station is in

development. When completed, it will provide 1,200 megawatt hours of electric power to the station per year.

Biomass & Landfill Gas

- A 1.3-megawatt landfill gas project has been in operation at Hill AFB, Utah, since 2004.
- A 5.4-megawatt industrial waste-to-energy cogeneration project has been awarded at Dyess AFB, Texas, and is scheduled to begin operation in 2007.

Solar

- A 90-kilowatt photovoltaic project at Ascension Island is currently in operation.
- A 300-kilowatt photovoltaic project is under construction at March ARB, Calif., and work will begin soon on a 100-kilowatt photovoltaic project for the base.
- An 895-kilowatt photovoltaic project is planned for Fresno ANGB, Calif.
- A 122-kilowatt photovoltaic project at Luke AFB, Ariz., became operational this year.
- We are also working with industry to explore placing large-scale photovoltaic projects on Air Force installations. These contractor-owned projects would provide a long-term renewable power supply for the installations, and any excess generation could be sold to the local electric utility.

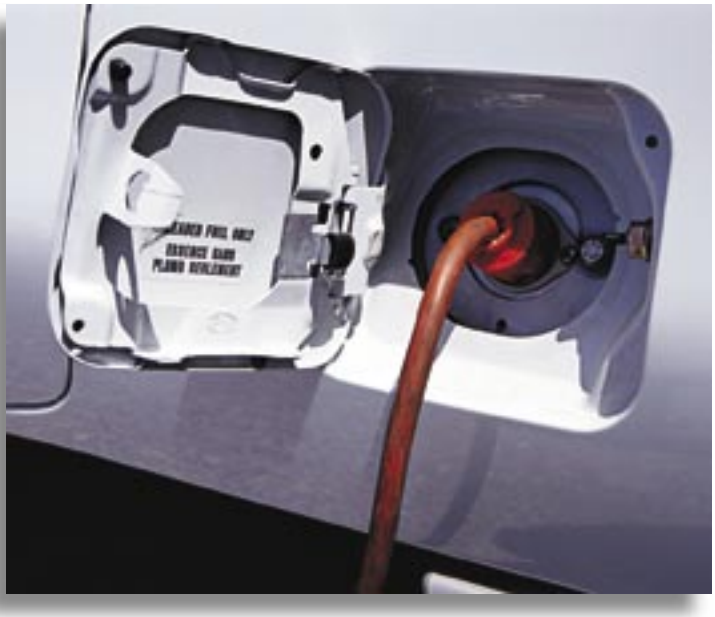
Geothermal & Other Renewable Sources

- More than 3,500 ground-source heat pumps are currently operating at eight installations.
- Whiteman AFB, Mo., will begin converting six dormitories to ground-source heat pumps this year. When the conversion is completed, the projected annual savings is 20,400 megawatt hours.
- A ground-source heat pump project for dormitories at Offutt AFB, Neb., will come online this year, saving an estimated 2,760 megawatt hours a year when completed.

Vehicle and Equipment Energy

There are more than 92,000 vehicles and hundreds of thousands of pieces of support equipment in the Air Force's inventory that rely on petroleum-based fuels. While not all can be converted to non-fossil fuels, our Advanced Power Technology Office at Robins AFB, Ga., is helping the Air Force adopt a variety of advanced renewable energy technologies and integrate them into as many platforms as possible.

Currently, our fleet of converted vehicles and equipment is small but, as technologies mature and additional alternative fuel choices are developed, our inventory will grow. Because of the high initial cost associated with purchasing alternative-energy vehicles and equipment and establishing the infrastructure to support them, our focus has been on research and development to ensure the vehicles and equipment are robust and dependable enough to meet our needs without draining resources and manpower or having a negative impact on mission readiness.



The Air Force began looking at alternative-fuel vehicles in 1992. Working with automobile manufactures and equipment suppliers, we tried to find the right mix of reliability, performance and cost. Several technologies were evaluated, but none were ready for operational use.

Industry continued to improve the performance of alternative-fuel vehicles; in 1997, the first electric vehicles began service in the Air Force. That year, we also began purchasing pick-up trucks that used compressed natural gas. By 1999, our inventory included "flex fuel" vehicles that could use either petroleum or renewable fuels such as E-85, ethanol and B-20.

The newest alternative energy vehicles are hybrid systems that use multiple power sources, and vehicles and equipment that use synthetic fuels.

Hybrids & Hydrogen Fuel Cell Vehicles

Hybrid vehicles and equipment use both generators and stored energy, such as batteries, to meet peak requirements. Our inventory of in-service and demonstration hybrid vehicles includes a diesel-electric Harland tow vehicle at Selfridge ANGB, Mich., and Robins AFB, Ga; a diesel-electric flight line support van at Hickam AFB, Hawaii; a hydrogen-electric-powered fuel cell bus

at Hickam AFB; and a hydrogen fuel cell crew van at Hickam AFB.

Additionally, there are concept demonstrators and prototype vehicles being designed and manufactured by industry. These new vehicles include a hybrid R-11 aircraft refueling truck, fuel-cell-powered aircraft tow tractors, fuel-cell-powered cargo loaders and a hybrid bomb lift.

We are also working with industry to develop alternative-fuel technology to support ground equipment and facilities such as our bare base assets and modular mobile units. These projects are advancing hydrogen generation, storage and refueling capabilities, and helping to increase fuel cell efficiency.

Advanced Electrical Vehicles

Electric-powered pick-ups and forklifts are in use on Air Force bases today, and new technologies, like advanced lithium ion batteries and improved electric motors, will provide even greater performance and reliability in the future. These advanced batteries, coupled with fuel cell technology and hybrid systems, will help extend the performance and range of the vehicles and help the Air Force further reduce its oil consumption.

Synthetic Fuels

Synthetic fuels are an integral part of the Air Force's overall green power strategy. Some of these fuels—ethanol and methanol—are in use today. We are working with industry and academia to develop additional synthetic fuels, such as fuel made from liquefied coal. Synthetic fuels from biomass sources, including agricultural and wood products, will provide additional renewable availability.

The Air Force has long been the leader within DoD in energy conservation. We will continue to aggressively integrate advanced energy technologies into day-to-day operations at our installations, not only because it makes good economic sense, but because it helps maintain mission readiness while meeting quality-of-life requirements to support our Airmen.

Air Force Energy Facts

- The modern-day energy program for the federal government began in 1975 with enactment of the Energy Policy and Conservation Act. The act required federal agencies to reduce energy consumption by 20 percent by 1985. It was the beginning of several mandated reductions that continue to this day with the Energy Policy Act of 2005. That act requires federal agencies to reduce energy usage by 2 percent per year for the next eight years.

- The Air Force is the leading government consumer of energy, especially fuel. It consumes more than half of all fuel purchased by federal government agencies.

- Air Force facilities account for 16 percent of Air Force energy usage; ground vehicles and equipment account for 2 percent of usage.

- The Air Force purchased more than 1,059 gigawatts hours of wind power in FY05.

- Biomass is used to produce 1.2 megawatts of power at Hill AFB, Utah.

- The Air Force has more than 3,500 ground-source heat pump units installed at bases around the world.

- The Air Force received the U.S. Environmental Protection Agency's 2005 Green Power Leadership Award for its renewable energy program.

- The first electric vehicles began service in the Air Force in 1997.

- About a third of the vehicles in the Air Force inventory use flex fuel.

- In FY 2005, the Air Force reduced its fossil fuel consumption 10.6 percent from the FY 1999 baseline.

- The Air Force plans to make biodiesel the primary diesel fuel used in USAF-operated General Services Administration vehicles at stateside bases (where applicable).

- The Air Force's Advanced Power Technology Office has 13 Air Force-specific projects involving hydrogen fuel cells and electric prototype vehicles and 13 joint-service fossil fuel conservation projects.

- The Air Force will program 75 percent of new light-duty vehicles purchased to be capable of using alternative fuel.

The Air Force facility energy program is managed by the Air Force Civil Engineer Support Agency's Energy Management Team. The agency is located at Tyndall AFB, Fla. For more information on the Air Force facility energy program, visit the AFCESA website at http://www.afcesa.af.mil/ces/cesm/energy/cesm_energy.asp, or contact the energy helpdesk at afcesaenergy.helpdesk@tyndall.af.mil or phone 850-283-6236 (DSN 523-6236).

The Air Force alternative fuels program for ground vehicles and equipment is managed by the Air Force Advanced Power Technology Office at Robins AFB, Ga. For more information on the APTO, write them at 542sevsg.gbzva.aptoinfo@robins.af.mil.

This brochure was produced for Headquarters U.S. Air Force by the Air Force Civil Engineer Support Agency.

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